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CODE OF PRACTICE FOR APPLICATION OF TEMPORARY CORROSION PREVENTIVES

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 6 *September* 1971

Indian Standard
CODE OF PRACTICE FOR APPLICATION OF TEMPORARY CORROSION PREVENTIVES

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Indian Standard

CODE OF PRACTICE FOR APPLICATION OF TEMPORARY CORROSION PREVENTIVES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 1 February 1971, after the draft finalized by the Lubricants and Related Products Sectional Committee had been approved by the Chemical Division Council and the Mechanical Engineering Division Council.

0.2 Metal articles are often required to be protected for short periods against corrosion during transport and storage. This code deals with the methods of preserving such articles for periods ranging from 3 months to 4 years.

0.3 For protecting the metal articles against corrosion for short periods, temporary corrosion preventives are used. These may be removed from the metal surface easily when required (*see* **0.4**). The preliminary steps of preservation are cleaning, removal of rust, scale and miscellaneous residues, washing and drying. It should be emphasized that the effectiveness of a particular temporary corrosion preventive will be reduced or even nullified if these steps are skipped. A sequence of these steps involved is given below:

First Step: Degreasing by

1) grinding, wire brushing, etc
2) using rust removers
3) cleaning by using petroleum solvents
4) alkali cleaning
5) trichloroethylene cleaning
6) ultrasonic cleaning
7) emulsion cleaning
8) liquid blasting
9) steam cleaning
10) flame cleaning

Second Step: Derusting and descaling

- *a) by mechanical methods, such as*
    - 1) scratch brushing
    - 2) shot or sand blasting
    - 3) barrelling
- *b) by chemical methods, such as*
    - 1) acid pickling
    - 2) electrolytic derusting
    - 3) tannin derusting

Third Step: Removal of miscellaneous residues

Fourth Step: Washing and drying

- *a) Washing, using*
    - 1) water
    - 2) washing soda solution
- *b) Removing moisture by*
    - 1) wiping the surface with cloth
    - 2) blowing air
    - 3) heating
    - 4) using dewatering agents
- *c) Drying by*
    - 1) heating
    - 2) centrifuging
    - 3) using hot solvent
    - 4) using water displacing fluids

Fifth Step: Applying corrosion preventives by

- 1) dipping
- 2) spraying
- 3) manual application (brushing, smearing, etc)
- 4) roller coating
- 5) flow coating
- 6) flushing
- 7) circulating
- 8) barrelling

NOTE — If at any stage it is felt that the subsequent step is not required, the same may be skipped.

0.3.1 In this code, these steps are dealt with in different sections.

0.4 Temporary corrosion preventives have to be removed from the metal surface after they have served their purpose except when the protective is compatible with the environment to which the protected components is exposed. However, they should not be removed until the components are ready for painting or otherwise safeguarded against corrosion. The choice of a particular method to be adopted for removing the corrosion preventive depends on the thickness and nature of the protective film and the equipment and facilities available.

0.4.1 Any suitable method using petroleum hydrocarbon solvents (*see* **3.3.3**) may be used for continuous removal of the temporary corrosion preventives. Often there is a need for treatment of a single article or a few articles at a time; for this immersion in a solvent in a suitable dish assisted by brushing may be employed. Wiping with fabric soaked in solvent may also be useful for local cleaning specially in the case of oily and greasy films.

0.5 It should be ensured that the various treatment chemicals employed in preparing the metal surfaces shall not have any deleterious effect on other parts of the metal component such as made of plastic, rubber and leather.

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1. SCOPE

1.1 This standard lays down a code of practice for application of temporary corrosion preventives to metal articles for prevention of corrosion during transport and storage.

SECTION I DEGREASING

2. NECESSITY

2.1 Before a corrosion preventive is applied on a metal surface it is important that the surface is oil, grease- and moisture-free and is clean; otherwise the protective may not adhere to the surface and come off, in some cases it may even get emulsified. So a prerequisite for any surface to take a protective is that it shall be degreased, derusted and freed from dirt.

2.2 Finished machinery that has been handled with reasonable care may not require much cleaning. But the metal stock and partially finished work pieces on the other hand require thorough cleaning against the commonly found impurities, such as oil, grease, water, perspiration and residues derived from it, dust, chemical deposits from the atmosphere and products of corrosion that have been formed on the metal surface. Particles of solid matter such as swarf or scale may prevent the access and adherence of the protective to the metal surface, thus leaving the concerned areas susceptible to corrosive attack. Sometimes contaminants remaining from manufacturing operations are themselves capable of greatly increasing the rate at which corrosion attack may occur.

3. DEGREASING METAL SURFACE

3.0 There is no single method by which all metal surfaces may be prepared for the application of protective coatings. The individual methods that shall be used depend upon the type of contamination to be removed, nature of the surface to be cleaned and type of impurities. If no further treatment of the metal surface is desired, immediately after degreasing, the temporary corrosion preventive shall be applied without any delay; otherwise rusting may take place.

3.1 Grinding, Wire-Brushing, Sand Blasting and Pickling

3.2 Using Suitable Rust Removers

3.3 Cleaning by Using Petroleum Hydrocarbon Solvents

3.3.0 Petroleum hydrocarbon solvents may be applied *in situ* on large units by brush or metallic components may be dipped in the petroleum solvents for degreasing them. General methods followed for processing are described in 3.3.3 to 3.3.5; the choice of appropriate process to be selected depends upon the type and degree of contamination and the size of metal components to be degreased. Temporary corrosion preventive may immediately be applied on the metal surface after cleaning, if derusting is not desired. In any case, after cleaning the parts with the petroleum solvents, these require drying in order to remove the residual solvent. Drying may be accomplished by using compressed air blasts or by placing the articles in appropriate ovens if their size permits. In case of assemblies containing fabric, rubber or other non-metallic components where the petroleum solvents attack these things, petroleum solvent cleaning shall not be adopted.

3.3.1 *General Precautions While Cleaning by Petroleum Solvents* — Articles shall be placed on hooks or racks or in suitable containers that permit adequate draining. After cleaning they shall not be handled with bare hands. Oil resisting synthetic-rubber gloves or other protective measures shall be used while handling the articles in order to protect them from sweat residues and the skin from the effect of these solvents. The place where cleaning operation is done shall be airy. Care shall be taken to avoid breathing the petroleum vapours. Petroleum solvents shall be used at room temperature and suitable fire extinguisher shall be provided to meet any eventuality that may arise because of fire hazard of these solvents.

3.3.2 *Quality of Petroleum Solvent Used* — The petroleum solvent used shall be a neutral petroleum fraction having a minimum flash point of 35°C

(*see* IS : 1745-1966*). A lower flash point solvent may also be used provided adequate fire precautions are taken.

3.3.3 *Immersion Cleaning* — This method may be used for unit parts or assemblies when the degree of contamination is light and mild cleaning is required. The articles shall be immersed in the solvent, taken in a tank (cleaning tank) provided with tight-fitting metal covers, long enough to allow removal of contaminants. Brushing or scrubbing and agitation aid speed the cleaning operation. In case of use of automatic conveyors for placing the articles, means shall also be provided to agitate the solvent in the tank. Articles with cavities that may hold the solvent shall be so immersed that the holes are filled with the solvent. For removing the contamination from the holes, the articles shall be removed from the solvent tank at such an angle that these holes are emptied. Repeated dipping and agitation may be necessary to flush out solid material such as swarf. The articles shall then be immersed in a second tank of clean solvent (rinsing tank), the solvent being agitated in it, if possible. The articles shall be kept dipping in this solvent for at least one minute to remove the film of contaminated solvent from the cleaning tank. Care shall be taken to carry over as little solvent as possible from the first to the second tank.

The solvent shall be checked periodically for dirt and contamination and replaced when contamination causes unsatisfactory cleaning or reaches 2 percent of the solvent. The dirt content may be determined by evaporating a measured volume of the solvent until the oily and solid residues remain, and then weighing these residues. Pure solvent from the contaminated solution may be reclaimed by distillation. When solvent tanks are not in use, they shall be kept tightly covered in order to minimize contamination by atmospheric dirt, moisture and loss by evaporation.

After cleaning excess solvent shall be drained off from the article.

NOTE — The solvent from the rinsing tank may be transferred to the cleaning tank whenever the solvent of the latter becomes too contaminated to be used. The rinsing tank shall then be refilled with fresh solvent.

3.3.4 *Cleaning by Brushing or Wiping* — This method is intended for local application to bare metal areas on assemblies containing painted surfaces or non-metallic inserts that may be damaged by a general application of solvent. Oil, grease and light dirt contamination may be removed by this method. It may also be used for the *in situ* cleaning of articles too large for immersion tanks or spray cleaning system.

Petroleum solvent shall be applied to the contaminated areas with a clean brush or a cloth soaked in the solvent; the application of clean

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*Specification for petroleum hydrocarbon solvents (*first revision*).

solvent, with scrubbing or wiping, shall be repeated until all contamination has been removed. Care shall be taken to apply the solvent to the contaminated metal areas only.

3.3.5 *Spray Cleaning* — This method may be used to remove oil, grease and light dirt or swarf contamination from unit parts or very simple assemblies, provided that all surfaces may be reached by the sprayed solvent and none tends to trap the solvent.

The parts shall be suspended in or passed through the spraying zone, the spraying arrangements and the cleaning time being suitably adjusted to obtain thorough cleaning. The pressure used for spraying the solvent shall be strong enough and the spray nozzles shall be so placed and directed that all surfaces of the article are reached. A solvent recirculating system equipped with screen or filters shall also be provided. The equipment shall be inspected frequently to see that the spray nozzles are not clogged. The screen or filters in the solvent recirculating system shall also be periodically cleaned.

3.4 Alkali Cleaning

3.4.0 A mild or strong alkaline solution may be used for cleaning depending upon the contaminants. Trisodium phosphate and sodium meta silicate solutions containing wetting agents are often used as mild alkalis. Strong alkaline solutions include sodium hydroxide. The concentration of alkali solution shall not exceed 6 percent. Special care is to be taken while using alkalis as they attack non-ferrous metals and paints; highly polished surface is also damaged by these. Alkali cleaning shall not be used for articles containing porous components. Alkali cleaning shall also not be used in case the components having some zinc, tin, and aluminium parts which are attacked by the alkali. The methods followed are described in **3.4.2** to **3.4.4**. After cleaning, the components shall be thoroughly washed with water to completely remove the alkali.

3.4.1 *General Precautions While Alkali Cleaning* — Strong alkalis injure the eyes and skin. Operators handling the articles during and after cleaning shall wear gloves. Goggles and protective clothing shall also be worn when alkaline solutions are handled, or if there is any danger of their splashing.

3.4.2 *Immersion Cleaning* — The articles to be cleaned shall be immersed singly or in batches on racks or trays in a steam heated tank containing the alkaline solution. The temperature of the solution shall be maintained at 80 to 95°C and the articles immersed for one to ten minutes. Cleaning may be assisted by agitation of the solution or of the article. After alkali cleaning the components shall be thoroughly washed in running water to remove the alkali completely.

3.4.3 *Spray Cleaning* — Jets of alkali solution may be directed on the surface of metal to be cleaned.

3.4.4 *Electrocleaning* — Alkaline solutions are used in electrocleaning which is suitable for cleaning of small parts made of ferrous metals or known metals unharmed by alkalis. The cleaning tank contains alkaline solution as the electrolyte, and the articles to be cleaned form one of the electrodes. It is advised that the article should be made anode. An electric current of 0·025 to 0·050 A/cm^2 of the area of the metal to be cleaned at 4 to 8 volts shall be passed through the solution, causing electrolysis accompanied by evolution of gas on the electrode surface. This has the effect of producing a powerful scrubbing action assisting removal of the contaminants.

3.5 Trichloroethylene Cleaning

3.5.0 Trichloroethylene cleaning may be used to remove oil and grease from the surface of metal. The various methods that may be used in case of trichloroethylene cleaning are described in **3.5.1** to **3.5.3**. The choice of a method depends upon the size of the component to be cleaned and degree of contamination.

3.5.1 *Vapour Cleaning* — The principle involved in trichloroethylene vapour cleaning is vaporising trichloroethylene by heat and condensing the vapours on components desired to be degreased, so that, condensed trichloroethylene dissolves oils and greases on the component and pass on to the main bulk of the solvent in the bath. The method is efficient since pure trichloroethylene vapours uncontaminated with oil and grease always come in contact with the components.

The apparatus used shall consist essentially of a bath containing trichloroethylene at the bottom. The bath shall be fitted with electric heater to volatilize the solvent The upper part of the bath shall be cooled by a jacket of water with inlet and exit for it. The temperature of the upper part of the bath shall be maintained as near the room temperature as possible, by passing tap water through the jacket. Hooks shall be provided to cover the bath so that components in singles or wire baskets containing a number of components may be hung from these.

The components shall be hung from the hooks provided on the underside of the cover plate. The apparatus shall be run, so that there is copious condensation of the solvent on the components. After about 15 to 30 minutes, the components may be taken out and degreasing may be ensured by water break test (*see* **3.11**).

3.5.2 *Spray Cleaning* — Jets of boiling trichloroethylene may be directed on the surface of metal to be cleaned.

3.5.3 *Immersion Cleaning* — Soiled components may be immersed in trichloroethylene contained in tanks and loose deposits of dirt, oil, grease and residues of polishing components left on the metal surface removed.

3.6 Ultrasonic Cleaning — This is a modern method in which supersonic waves are hammered on metal surface to free it from deposited contaminations. Ultrasonic vibrations assist grease removed by solvents or aqueous solution containing alkalis or organic detergents.

3.7 Emulsion Cleaning

3.7.0 The principle involved is loosening the grease or oil on metal surface by a concentrated emulsifier/solvent mixture which, during washing, readily forms an emulsion. With more water, the emulsion so formed is washed down mechanically, carrying away the loosened oil or grease. Inferior kerosine (*see* IS : 1459-1968*) and white spirit (*see* IS : 1745-1966†) emulsion in water containing some emulsifier or some other suitable emulsion may be used. The method is suitable for moderate cleaning work specially where trichloroethylene or alkali cleaning is not suitable and where *in situ* cleaning is required. The methods that may be followed are described in **3.7.1** to **3.7.3**.

3.7.1 *Immersion Cleaning* — The component shall be immersed in the emulsion for a period extending up to 10 minutes with brushing it, if necessary. The component, after withdrawing from the bath, shall be hung over it to allow the excess emulsion to drain out into the bath. It shall then be washed with a jet of water or steam till no more milky emulsion is produced on the surface of the component.

3.7.2 *Spray Cleaning* — A jet of weak emulsion at a suitable temperature above the room temperature shall be directed on the component to reach the surfaces to be cleaned. The component shall then be washed in spray of cold water. It may also be dipped in hot water before drying.

3.7.3 *In Situ Cleaning* — Large components, handling of which is difficult, may be cleaned by brushing the emulsion on the component *in situ*. After the liquid is in contact with the component surface for sufficient time, it shall be washed away with a jet of water or steam.

3.8 Degreasing by Liquid Blasting — This process consists of blasting the component to be degreased with a liquid, usually water. Liquid blasting is preferred to sand blasting as it avoids the possibility of causing silicosis to the operators when using sand for this purpose.

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*Specification for kerosines (*first revision*).

†Specification for petroleum hydrocarbon solvents (*first revision*).

3.9 Steam Cleaning

3.10 Flame Cleaning — This method is recommended (where others are not considered suitable) for metallic plates and sections of more than 6 mm in thickness. Non-uniform heating of the surface during flame cleaning should be avoided as far as practicable to ensure freedom from buckling.

3.11 Test for Ensuring Proper Degreasing — In case of small articles which may be dipped in water, the surface of the metal component shall be taken to be degreased if on immersion in water and subsequent withdrawal of the component, the surface is completely wetted without any water breaks.

SECTION II DERUSTING AND DESCALING

4. NECESSITY

4.1 It is often found that a metal surface is not only oily, greasy and moist but also rusty. As pointed out earlier, full advantage of corrosion preventives is not obtained if they are not in intimate contact with the metal surface. In a number of cases scales on metal surface are formed during the course of various treatments in the manufacture of the component, such as hot rolling, heat treatment and welding. It is important to remove rust and scale and swarf from the metal surface.

4.1.0 A rusted article, when required to be preserved with a corrosion preventive, shall first be degreased as detailed in Section I and then derusted.

5. DERUSTING AND DESCALING METAL SURFACE

5.0 Processes that are used for derusting a metal surface may be divided into two main heads mechanical processes and the chemical processes. The size, shape, type of finish of the component as well as the process that was used for its construction, the tenacity and thickness of the rust coating determine the individual method that may be adopted for derusting.

5.1 Mechanical Processes*

5.1.1 *Scratch Brushing* — may be used for removing non-adherent rust and scale using wire or other suitable brushes (*see* IS : 3015-1964† and IS : 4301-1967‡).

5.1.2 *Shot or Sand Blasting* — may be used for all surfaces except the machine finished.

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*For more details, *see* IS : 6005 - 1970 Code of practice for phosphating of iron and steel.

†Specification for brush, scrubbing.

‡Specification for brushes, foundry, flat.

CAUTION — Blasting with silica sand is extremely dangerous to health because on impact with surface, the sand is partially pulverized causing a mist of finely divided silica which may be breathed not only by the operator but by others also in the vicinity. Wet sand blasting, in which the sand is carried on a jet of water, has a similar though less marked effect. Therefore, if the operator has to work within the blast cleaning enclosure, he shall be provided with suitable protective clothing including a hood with an external air supply. The blasting enclosure should have an exhaust ventilation system equipped for dust extraction and the blazing nozzle should be fitted with a dead man trigger or remote control. Particular care should be given to the cleaning of floor, walls, fixtures and fittings within the chamber to avoid dangerous accumulation of aluminium and zinc dust which may be flammable if raised in dense clouds. Strong lighting should also be provided as the dust obscures the work specially when expandable abrasives are used.

5.1.3 *Barrelling Using Suitable Abrasives*

5.2 Chemical Process

5.2.0 The chemical methods which may result in hydrogen embrittlement shall not be employed in case of high tensile strength steel.

5.2.1 *Acid Pickling Process*

5.2.1.0 The strength of the acid used in acid pickling processes depends upon the extent of rusting or scaling to be removed. The articles of complicated shapes or having crevices and blind holes shall not be acid pickled. Riveted or spot welded articles shall not be acid pickled. Cast iron components shall also not be acid pickled due to the possibility of occlusion of the acid. After acid pickling, the component or their concerning parts shall be washed with water followed by a solution of 1 to 5 percent washing soda.

5.2.1.1 *Phosphoric acid pickling* — Phosphoric acid pickling not only removes rust and scale from the surface of metal but also forms on the metal surface a fine coating of iron phosphate which acts as a preservative. Thus, though this method is costlier among the various acid pickling processes, yet it is preferred.

At least 60 percent solution of phosphoric acid (*see* IS : 798-1968*) in water with or without butanol (*see* IS : 361-1962†) and denatured spirit (*see* IS : 324-1959‡) shall be used. This acid solution shall also contain suitable wetting agent and corrosion inhibitor. The chlorides (as NaCl)

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*Specification for ortho phosphoric acid (*first revision*).

†Specification for normal butyl alcohol, technical (*revised*).

‡Specification for ordinary denatured spirit (*revised*).

and sulphates (as Na_2SO_4) in it shall not exceed by 0·1 and 0·2 percent and arsenic (as As_2O_3) and antimony (as Sb_2O_3) each by 8 parts per million respectively. A degreased and clean black plate (*see* IS : 597-1962*) when immersed for a period of 6 hours in a 1 : 1 solution of pickling acid solution and water at a temperature of 40 ± 1°C shall not show a loss of metal by more than 1 g/dm^2 of the area of the black plate.

The article shall be pickled in the 1 : 1 pickling acid taken in a suitable tank kept at a temperature of 60°C depending upon the degree of rusting and scaling of the article. Occasional brushing with steel wool may also be done for quick removal of the contamination. After derusting, the article shall immediately be washed first with cold and then with hot water before drying.

NOTE — Light rust may also be removed by brushing the acid solution on the article followed by washing.

5.2.1.2 *Sulphuric acid pickling* — In lead tanks 5 to 20 percent sulphuric acid solution containing suitable inhibitors† shall be taken. The acid solution shall be maintained at a temperature of 60 to 85°C and the article shall be immersed in it. Occasional agitation of the solution and scratch brushing of the article may be resorted to speed up derusting.

CAUTION — For preparing the acid solution, always add acid to the cold water and never the water to the acid.

5.2.1.3 *Hydrochloric acid pickling* — Hydrochloric acid solution 1 to 50 percent containing suitable inhibitor‡ taken in acid resistant tanks made of glass, glazed earthenware or rubber lined tanks at room temperature may also be used for removing rust and scales from the metal.

5.2.1.4 *Sulphuric — phosphoric acid pickling* — The article shall be first dipped in a tank containing 5 to 10 percent (*v/v*) suitably inhibited sulphuric acid solution (*see* Note) kept at a temperature of 60 to 65°C. After draining off the acid, the article shall be dipped in a warm water tank maintained at 60 to 65°C wherein a water flow is maintained in order that the concentration of the acid does not exceed 0·1 percent. The component shall now be pickled for 3 to 5 minutes in another tank containing 2 percent phosphoric acid solution (*see* Note) maintained at a temperature of about 85°C. In order to avoid derusting of the metal, the metal component shall be taken out, dried quickly and the temporary corrosion preventive applied over the metal surface after this treatment.

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*Specification for black plate for tinning and tinplate (pack rolled) (*revised*).

†One percent of Rodine 82 calculated on the weight of the acid may be added to it as inhibitor.

‡One percent Rodine 213 has been found useful as an inhibitor.

NOTE — The acids in the tanks shall be wholly or partially changed when the derusting rate reduces remarkably or the iron content rises beyond the following limits:

a) For sulphuric acid	80 g/l
b) For hydrochloric acid	120 g/l
c) For sulphuric acid — phosphoric acid	First bath — 70 g/l Second bath — 5 g/l

5.2.2 *Electrolytic Derusting*

5.2.2.1 *Cathodic cleaning* — The component shall be made the cathode with an auxiliary anode using an acid or alkali as the electrolytic solution and a suitable current shall be passed. Quick removal of rust and scale may be achieved by this process. There is less danger of hydrogen embrittlement (*see* **5.2.0**) in case of use of alkali electrolyte than in case of use of acid electrolyte though the former method is slower than the latter.

5.2.2.2 *Anodic cleaning* — In this case there is no danger of hydrogen embrittlement. For electrolytes both acid as well as alkali may be used.

5.2.3 *Tannin Derusting* — After degreasing and mechanical derusting to remove the loose rust, derusting may be effected by applying with a hand brush, an aqueous solution containing *KHARDE* or mangrove extract, myrobalan extract, formalin, a suitable wetting agents molasses or glycerine and phosphoric acid. After the coating is dry, it shall be worked with a brush to remove the friable black iron tannate. Depending upon the thickness of the rust, this operation may be repeated till the surface is completely derusted.

SECTION III REMOVAL OF MISCELLANEOUS RESIDUES

6. REMOVAL OF MISCELLANEOUS RESIDUES

6.0 This section deals with the removal of miscellaneous residues like heat treatment salts, fluxes and sweat residues.

6.1 Removal of Heat Treatment Salts

6.1.0 Heat treatment salts may contain water soluble cyanides, carbonates, chlorides or fluorides of sodium or potassium with or without less readily soluble barium chloride.

6.1.1 The heat treatment salts shall be removed by washing in clean hot water for 5 minutes for articles of simple shape and up to 1 hour for articles having crevices or that are coated with salts containing barium chloride. After removing the soluble salts, the article shall be rinsed in a second tank in order to remove the adherent residue.

6.1.2 If the heat treatment salts contain barium, the articles shall be soaked in hot water, transferred for a few minutes while in hot condition to a bath containing the cold solution made from the water, 10 to 30 percent hydrochloric acid and an inhibitor, swilled in cold running water and finally rinse in clean hot water. This treatment shall, however, not to be used for the heat treatment salts comprising of cyanides.

6.1.3 After cleaning, the articles shall be dried (*see* 9) and the temporary corrosion preventive shall be applied immediately.

6.2 Removal of Fluxes

6.2.0 The fluxes used in soldering, brazing or welding invariably contain hygroscopic chlorides or fluorides or both. These are required to be removed in order to prevent the metal corrosion.

6.2.1 Fluxes may be removed by washing the articles in water thoroughly. If necessary a little amount of dilute sulphuric acid may also be added to the rinsing water. Scrubbing with brush may be used to remove incrustations.

6.2.2 The fluxes from articles which have been brazed with a borate flux may be removed by first cleaning the article in dilute sulphuric acid and then washing and scrubbing in water.

6.2.3 Fluxes of organic nature shall be removed by the methods prescribed under degreasing (*see* Section I).

6.3 Removal of Sweat Residues

6.3.1 Sweat residues shall be removed by alkali cleaning processes (*see* 3.4).

6.3.2 In certain cases suitable oil-in-water emulsions may also be used.

6.3.3 Methanol containing 5 percent water is also found suitable for the removal of sweat residues.

SECTION IV WASHING AND DRYING

7. WASHING

7.0 After degreasing (except solvent degreasing) or derusting (except phosphoric acid, sulphuric acid derusting) or after applying both the treatments, it is important that the metal shall be washed in order to completely remove the contaminations. Washing may be accomplished by using the following substances.

7.1 **Water** — A jet of hot or cold water depending upon the need shall be directed on the component. Washing may be facilitated by the use of suitable brushes (*see* IS : 2701-1964*).

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*Specification for brush, carriage washing (without handle).

7.2 Washing Soda Solution — In case of acid pickling, after washing with water, the articles shall also be washed with 1 to 5 percent washing soda solution in order to neutralize the acid that may be adhering to metal. After removal from the washing soda solution, metal parts should be thoroughly swirled in hot water and dried.

8. REMOVAL OF MOISTURE

8.1 Wiping the Surface with Clean and Dry Cloth

8.2 Blowing Clean, Dry and Oil-Free Air Over the Metal Surface

8.3 Heating the Metal Component in Drying Ovens

8.4 Using Dewatering Agents to Displace Water

9. DRYING

9.0 After washing the metal component, it shall be immediately dried and corrosion preventives applied on it; otherwise rusting may occur. For drying the following methods may be used.

9.1 Drying by Heating

9.1.1 *Hot Air-Oven* — Heating in an air-oven at a temperature of 120 to 170°C is most suitable to articles washed by water after cleaning. Lower temperature may be used in drying components having low melting point non-metallic parts, or in cases when heat effects the properties of the material. The air may be circulated by using suitable fans and the used air which is moist shall be discarded.

9.1.2 *Infra-red Radiation* — may be effected by conveying the articles through a tunnel fitted with infra-red element. Very large articles may be dried by a build-up of element around them.

9.1.3 *Warm Air Blast* — may be accomplished by means of a fan forcing clean, dry air across a heating zone.

9.1.4 *Hot Water* — Washing the article may be accomplished by hot water itself in which case drying is easier. Drying may be accomplished by using air blasts.

9.2 Drying by Centrifuging — It may be used in case of small articles.

9.3 Drying with Hot Solvent — Water may be quickly removed from any free surface by immersing the article in a boiling chlorinated solvent containing a suitable additive. This may later be dipped for a minute or less in boiling solvent and when taken out the solvent is allowed to evaporate from its surface.

9.4 Using Water Displacing Fluids — In case of removing water by dipping the article in a tank containing the water displacing fluids, water displacing fluid should be discarded when the water displacement properties of the metal have significantly deteriorated.

NOTE — In case the metal part is to be protected from corrosion by using hot dipping type temporary corrosion preventives, the latter should be applied after the solvent from the surface of the metal has completely evaporated.

9.5 Blowing with Compressed Air — The compressed air used shall be clean and dry and used at suitable pressure. Moisture traps and air filters should be provided in the air delivery system and shall be regularly inspected and cleaned.

9.6 Drying by Wiping — This method may be used when the other methods are not found suitable. The cloth or waste that is used for wiping shall be clean and dry and shall not leave lint on the dried surface. The process may be completed in two operations, the first being drying the metal to a reasonable extent and the second completing the operation.

SECTION V APPLICATION OF TEMPORARY CORROSION PREVENTIVES

10. PREVENTION OF ATMOSPHERIC CORROSION

10.1 Under ordinary atmospheric conditions, corrosion occurs if both moisture and air have access to the metal surface specially when the surface is clean. The various methods of prevention of metal corrosion are, therefore, designed to check the reaction of moist air with metal. The best means is to cover the metal surface by impervious coating. Chances of corrosion may also be minimized during transport and storage, if due care is given to cleanliness and control of environment of stores for low humidity and exclusion of volatile contaminants. For complete prevention of corrosion, temporary corrosion preventives are used which protect the metal for a period (*see* **0.2**) as long as necessary and when they have served the purpose, they are readily removed without causing any damage to the equipment on which they were used. Application of impervious coating of these temporary corrosion preventives is by far the most flexible and widely used method of protection against corrosion.

10.2 The various temporary corrosion preventives that are used on metal surface are classified according to the type of film that they produce on metal surface, namely, hard, soft and oily and their method of application.

10.3 Users should choose the correct preservative, depending upon the article to be preserved, the period for which preservation is required, the environment of the stores where the preserved components would be exposed and the supplementary packaging available for use. Given below is a list of commonly available temporary corrosion protectives. The preventive selected should be such that it shall not have any deleterious effect on the parts of the component that are made from materials like plastic, rubber and leather:

a) Strippable, hot dip coating type (*see* IS : 6050-1971*);

b) Soft film, smearing type (*see* IS : 958-1958†);

c) Soft film, hot-dipping type (*see* IS : 6048-1970‡);

d) VCI powder (*see* IS : 5730-1970§);

e) VCI treated papers (*see* IS : 6263-1972 ‖) ;

f) Soft film, solvent deposited type (*see* IS : 1674-1960¶ and IS : 1154-1957**);

g) Hard film, solvent deposited (*see* IS : 1153-1957††); and

h) Oil type.

10.3.1 In case of ball bearings, battery terminals, bearing inserts, bicycle chains, brake cables, milling cutters, dies, dip heads, gauges, oil seals, piston assemblies, road springs, roller bearings, adjustable spanners, spring leaves, taps, etc, soft film hot dipping temporary corrosion preventives may be found suitable specially for long term protection.

10.3.2 Gun bores, electrical machines, machine flange faces, gears, bearings, hinges, journals of electrical machines, pulleys, screws (threaded parts), thread end of painted tubes, etc, may be preserved with soft film, smearing type temporary corrosion preventives.

10.3.3 Hard film, solvent deposited type of temporary corrosion preventives may be used in case of conjugation with mild steel bars, nuts and bolts, circular saws, crank shafts, cylinder liners, large size gears, gudgeon pins, hand tools, lay shafts, lathe beds, ploughs, plug rings, mild steel rods, light steel sections, shackle pins, spiral springs, washers, spades, showels, pick axes, etc.

10.3.4 Soft film, solvent deposited type of temporary corrosion preventives may serve the purpose in case of differential units, engine cylinders, ferrous and light alloy sheets, surgical instruments, etc.

10.3.5 Precision instruments, such as microscopes, binoculars, gauges, and small arms, may be preserved by volatile corrosion inhibitors.

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*Specification for temporary corrosion preventives strippable hot-dipping type.

†Specification for temporary corrosion preventive, grease, soft film, cold application.

‡Specification for temporary corrosion preventive soft film, hot-dipping type.

§Specification for volatile corrosion inhibitor powder.

‖Specification for volatile corrosion inhibitor treated paper.

¶Specification for temporary corrosion preventive, fluid, soft film, solvent deposited.

**Specification for temporary corrosion preventive, fluid, soft film, solvent deposited water displacing.

††Specification for temporary corrosion preventive, fluid, hard film, solvent deposited.

10.3.6 Small precision components, gauges, etc, which are not in frequent use may be protected by strippable hot-dipping type of preservative.

10.3.7 Mineral oils containing suitable corrosion inhibitors may be used as a protective for metal surfaces such as ICE cylinders and other components for short periods.

10.4 As pointed out earlier (*see* **0.3**) before the corrosion preventives are applied, the surface on which they are to be applied shall be prepared by degreasing, derusting, washing and drying. These corrosion preventives shall be applied immediately after the surface is prepared as the freshly cleaned metal surfaces are extremely vulnerable to corrosion attack.

11. METHODS OF APPLICATION

11.0 Choice of a particular method that may be adopted for applying the temporary corrosion preventives to the metal surface is governed by the nature of the protective, the size and shape of the article, the equipment and facilities available and whether the application is to the internal parts or external parts of the component.

11.1 Thickness of Film — The effectiveness of a corrosion preventive varies with its constitution and also with the thickness of the film. A reasonably thick film of the protective shall be applied over the metal. If a single application is not enough, the required thickness may be built up by repeated application. Before a repeat application, sufficient time shall be allowed for the first film to dry. Care shall be taken to ensure that existing films are not disturbed when subsequent films are applied. In case of dipping, reimmersion shall be very quick. With spraying, a limited quantity shall be applied, specially on vertical surfaces. Manual application shall not be too vigorous.

11.2 General Precautions — Most of temporary corrosion preventives are flammable and precautions against fire shall be taken. As the volatile solvents may be toxic, the process of the application of these shall be carried out in well-ventilated place.

11.3 Dipping

11.3.0 Dipping is the quickest of all the methods and produces an even and continuous thin film. It may be unsuitable with non-metallic components or for units that are too large or of too much irregular shape. As the protectives may be required to be removed after sometime, the holes, cavities and crevices in the component may be sealed or plugged after covering their inside surface with oily or soft corrosion preventives that may not require to be removed.

Protective oils and fluids may be applied by dipping at room temperature. In some cases, where the protectives are required to be melted (for example in the case of soft film, hot-dipping type or strippable hot-dipping type). They shall be kept at a temperature 10 to 20°C higher than their melting point and components dipped in them. However, heating shall not be violent.

11.3.1 *The Dipping Tank*

11.3.1.1 Dipping tanks enclosed by a jacket and heated with steam or oil if required shall be used. These shall be fitted with a cover to prevent the ingress of foreign matter and to restrict the evaporation of the solvent when not in use. While using, only appropriate opening of the door provided for this purpose shall be made. The tanks shall be fitted with drain cocks to facilitate draining of the protective fluid, the bottom of tank being sloped towards the drain cocks. In case of use of water displacing type of temporary corrosion protectives, another drain cock shall also be provided which shall be operated to drain off the displaced water. A screen shall be fitted in the tank near its bottom to prevent redispersal of substances sent to the drain when the fluid in the tank is agitated.

11.3.1.2 To compensate for the evaporation of the fluid which may occur during use, an appropriate solvent may be added in the fluid if recommended by the manufacturers.

11.3.2 *The Dipping Operation*

11.3.2.1 The articles to be coated shall be completely submerged in the protective and turned to allow entrapped air to escape. The fluid shall also be agitated from time to time. Duration of immersion shall be sufficient to allow complete wetting of the surface. Time of immersion may be prolonged to ensure complete displacement of water in case of fluid having dewatering fluids used for treating wet metal surfaces and attainment of tank temperature by the metal.

11.3.2.2 After removal of the articles from the dipping tank, these shall be allowed to drain and surplus protective shall be removed from these which may be used again. The articles in some cases may require drying before they are stacked.

11.4 Spraying — Suitable for treatment of bulky articles that may not be easily dipped. Any syrings or positive-displacement sprayer, or an air-operated sprayer using clean and dry air may be used. Care shall be taken to ensure that the coating is even and sufficient and an adequate amount has been applied; when the protective just begins to flow, spraying may be stopped. A coarse nozzle shall be used for the coating to be applied within a reasonable time, so that premature evaporation of the solvent and consequent uneven or discontinuous distribution of the film does not occur.

11.5 Manual Application — When dipping is impracticable and equipment for spraying not available, protective substances may be applied with a brush. Smearing may also be done in case of greasy type protectives. The progress may be slow and uneconomical where a large number of articles have to be treated. The use of a soft quality brush is recommended (*see* IS : 384-1964* and IS : 487-1966†) as coarse fibres tend to leave channels in the film. When large areas have to be covered, a swab may be used instead of a brush while using thinner protectives. Care shall be taken to ensure that sufficient protective is applied and that the protective film is even and continuous even at the sharp edges where a brush tends to displace a protective already deposited.

11.6 Roller Coating — Applicable to metallic sheets. The temporary protective is applied to the metal as it passes between the two soft rollers. The protective is fed on to the top roller by means of drip taps, the bottom roller rides in a trough containing liquid protectives.

11.7 Flow Coating — The protective in the liquid form is poured on the article which is rocked or tilted to ensure complete coverage.

11.8 Flushing — For tanks and other containers with relatively small orifices, oil type protectives may be applied by flushing.

11.9 Circulation — Particularly useful for preserving hydraulic systems using oil type protectives. Application may be effected by gravity flow or pumping throughout an enclosed system.

11.10 Barrelling — Applicable in the case of solvent deposited corrosion preventives may be affected in the following ways.

11.10.1 Predetermined quantities of corrosion preventives shall be charged in a suitable barrel containing the articles to be preserved and the barrel sealed and rotated for 5 to 10 minutes. The evolved solvent vapours may be extracted and the articles discharged.

11.10.2 Articles shall be placed in perforated barrel or open mesh basket so that $\frac{1}{3}$ to $\frac{2}{3}$ of its volume is occupied by the article and dipped into the corrosion preventive for 5 to 30 seconds and rotated. Afterwards the barrel is withdrawn and rotated again over the surface of the corrosion preventive for sometime and the article is withdrawn.

11.11 Use of VCI Powders — These inhibitors may be applied over the metal surface as such (in their powdery form) or in solution form. In certain cases the metallic components are kept in a closed box which contains the vapours of the material.

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*Specification for brushes, paints and varnishes, flat (*second revision*).

†Specification for brushes, paint and varnishes, (i) oval, ferrule bound, and (ii) round, copper wire bound (*revised*).

12. CHOICE OF WRAPPING

12.1 The preservation of a metallic surface depends on the protection afforded to it after the corrosion inhibitor has been applied. The articles shall not be touched till the corrosion preventive has set, also some protection shall be provided so that the film of the corrosion preventives does not come off by rubbing with other objects while storing or transporting them. Thus the use of a primary wrap is a dire necessity specially for soft film protectives. This wrap may be used to carry a supply of inhibitive material in addition to serving as a vapour barrier material against excessive rate of loss of volatile corrosion inhibitor as well as a water resisting barrier. In view of the close proximity to the metallic surface, the wraps shall not only be oil, grease- and moisture-resistant but also be such that they do not contain harmful amounts of corrosive materials such as chlorides and sulphates.

12.2 For economic reasons, the choice of wrapping or packaging the preserved component is governed by the protective used. Thus a less efficient protective available at a cheaper rate supplemented with good packaging may prove more beneficial than an efficient and costly protective used on a component and the component is not given adequate packaging. Among different materials for packaging, one may choose kraft paper (*see* IS : 1397-1967*), plain and waxed paper, greased paper, waterproof paper (*see* IS : 1398-1968†), some special type of paper such as, volatile corrosion inhibitor treated paper (*see* IS : 6263-1972 ‡), cartons with lining of polythene sheet or wax paper, polythene sheets, etc, with or without drying agent such as silica gel and alumina. Cartons used may also be dipped in wax compositions for effective barrier against water vapour and moisture.

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*Specification for kraft paper (*first revision*).

†Specification for packing paper, waterproof, bitumen-laminated (*first revision*).

‡Specification for volatile corrosion inhibitor treated paper.

INDIAN STANDARDS INSTITUTION

Headquarters:

Manak Bhavan, 9 Bahâdur Shah Zafar Marg, NEW DELHI 110002

Telephones : 26 60 21, 27 01 31 Telegrams : Manaksanstha

(Common to all offices)

Regional Offices :	*Telephone*
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†Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	36 24 99
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*Sales Office in Bombay is at Novelty Chambers, Grant Road, Bombay 400007 89 65 28

†Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep Street, Calcutta 700072 27 68 00

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TO

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Alterations

(Page 3, clause 0.3) - Delete Sl No. 1, 2, 8 and 10 and re-number the remaining serial numbers accordingly.

(Page 6, clauses 3.1 and 3.2) - Delete and re-number the remaining clauses accordingly.

(Pages 10 and 11, clauses 3.8 and 3.10) - Delete and re-number clauses '3.9 and 3.11' as '3.8 and 3.9'.

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